

XAL Status Report

Fall, 2008

Thomas Pelaia II

EPICS Collaboration Meeting

October 13-17, 2008



What is XAL?

- **Development environment for creating accelerator physics applications, scripts and services**
 - Control room applications
 - Analysis applications
- **Application framework**
- **Toolbox of Java packages**
- **Ant based build system (independent of IDE)**
- **Developed initially for the Spallation Neutron Source (SNS)**
- **Used in commissioning and running SNS**

Active Developers at SNS

- **Chris Allen**
- **Delphy Nypaver Armstrong**
- **Sarah Cousineau**
- **John Galambos**
- **Tom Pelaia**
- **Andrei Shishlo**
- **Yan Zhang**
- **Alexander Zhukov**

Collaboration

- Home: <http://www.ornl.gov/~t6p/Main/XAL.html>
- Source Forge Project: [xaldev](http://sourceforge.net/projects/xaldev)
 - <http://sourceforge.net/projects/xaldev>
 - Source code managed using Subversion
- Dozens of developers among several sites
 - SNS, SLAC, BNL, JPARC, GANIL and others
 - Paul Chu (**SLAC**) has been actively contributing to the SNS source code
- XAL 2 effort managed by Chris Allen
 - <http://sourceforge.net/projects/xal2>
- **Contact us** to participate

Applications, Scripts and Services

- **Five dozen applications covering:**
 - Accelerator Physics
 - Controls
- **Three services**
 - PV Logger
 - MPS Reporting
 - Trip Monitor
- **Many scripts**

Recent Work

- **Core Enhancements**
- **Bug Fixes**
- **Cleanup**
- **Application Development**
- **Collaboration**

Core Enhancements

- **Synoptic display handles wrapping with origin offset**
- **Message Center adds options for both latent and fresh posting of events**
- **Added Digital Filtering (ITR and FTR) classes**
- **Added Frequency Analysis classes**
- **Accelerator Applications**
 - improved accelerator and sequence validation
- **Applications support new view features**
 - document modification indicator
 - file path navigation in document title

Bug Fixes

- **Fixed multiple bugs in the MAD generator**
- **Fixed Thick Dipole to properly account for reference bend angle**
- **Fixed a race condition upon application startup**
- **Fixed broken HTML in API documentation**

Cleanup

- **Removed obsolete applications:**
 - **Loss Monitor, MPS Post Mortem, SCL AFF Monitor, Object Explorer, Charts, Orbit Display, XIO**
- **Removed obsolete files and directories**
 - **Directories: Config, Resources, bin**
 - **Several files**
- **Reduced the number of third party jar files**
 - **Removed: mem-moni, concurrent, cf-jca, cf, activation**
- **Ongoing Effort**

New Applications (sample)

- **Injection Dump Wizard**
- **Injection Painting**
- **Beam at Foil Control (HEBT and Ring)**
- **Optics Editor**
- **Bunch Shape Monitor Analysis**
- **CCL Orbit Correction**
- **Ring Tune Monitor**
- **Longitudinal Shaker**
- **Control BLM Limits**

Significant Application Enhancements

- **MTV**
 - Major update
- **Wire Analysis**
 - New Twiss matching algorithm
- **SCORE**
 - Support for string PVs
 - Disable obsolete PV groups
- **Loss Viewer 2**
 - Major update

MTV Enhancements

Andrei Shishlo

The screenshot shows the MTV application window with the following components:

- Menu bar: gov.sns.apps.mtv.Main, File, Edit, Accelerator, View, Window, Help
- Window title: mtv - (SCL) - Untitled.mtv
- Status bar: Selected Sequence is SCL
- Buttons: Magnets (selected), Arbitrary PVs
- Checkboxes: magnet, QH, QV, DCV, DCH
- Make Table button
- Table with columns: Magnet, B Set Main, B Set Trim, B readback, B Book
- Input field: SCL_Mag:PS_QD01:B_Set with value +004.73399
- Radio button: Bind to B_Book
- Upper Lim = 7.3, Lower Lim = 0.0
- Buttons: Restore Original Value, Memorize Value as Original

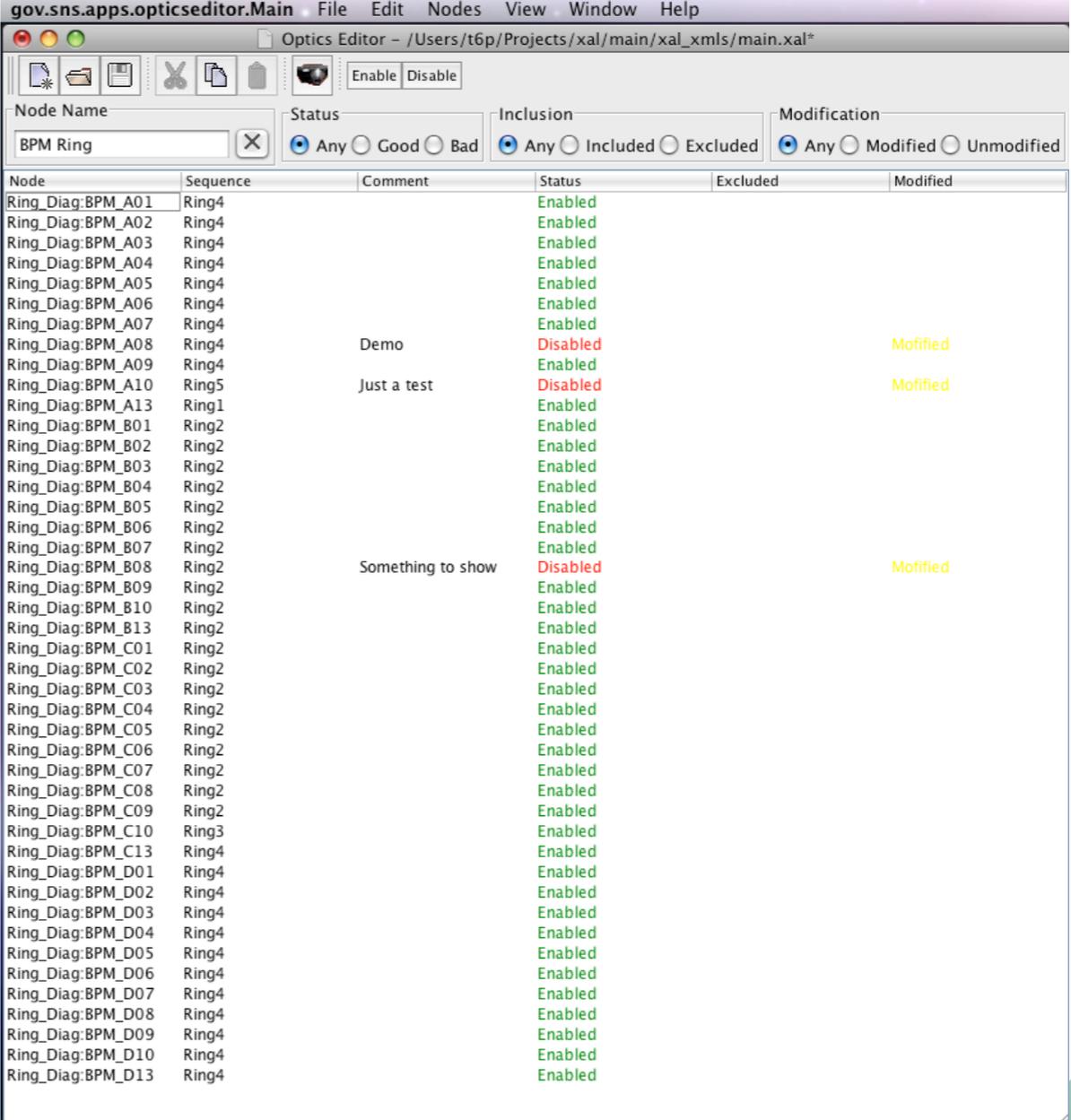
Magnet	B Set Main	B Set Trim	B readback	B Book
SCL_Mag:QH00	18.255		18.243	18.255
SCL_Mag:QV00	16.124		16.163	16.55
SCL_Mag:QH01	4.734		4.7342	4.734
SCL_Mag:DCH01	-0.0020247		-0.001991	
SCL_Mag:QV01	4.734		4.7333	4.734
SCL_Mag:DCV01	0.00011784		0.000097395	
SCL_Mag:QH02	4.95		4.9386	4.95
SCL_Mag:DCH02	-0.0013246		-0.0013274	
SCL_Mag:QV02	4.95		4.9392	4.95
SCL_Mag:DCV02	-0.00090426		-0.00090567	
SCL_Mag:QH03	5.1		5.2132	5.1
SCL_Mag:QV03	5.1		5.2175	5.1
SCL_Mag:QH04	5.1		5.1057	5.1
SCL_Mag:QV04	5.1		5.1066	5.1
SCL_Mag:QH05	5.1		5.1139	5.1
SCL_Mag:DCH05	-0.00057994		-0.00058426	
SCL_Mag:QV05	5.1		5.1153	5.1
SCL_Mag:DCV05	-0.00034116		-0.00036862	
SCL_Mag:QH06	5.1		5.1004	5.1
SCL_Mag:DCH06	-0.00058455		-0.00058736	
SCL_Mag:QV06	5.1		5.1001	5.1
SCL_Mag:DCV06	-0.00057072		-0.00057606	
SCL_Mag:QH07	5.1		5.1082	5.1
SCL_Mag:QV07	5.1		5.1122	5.1
SCL_Mag:QH08	5.1		5.118	5.1
SCL_Mag:QV08	5.1		5.116	5.1
SCL_Mag:QH09	5.05		5.0647	5.05
SCL_Mag:DCH09	0.00015962		0.00014965	
SCL_Mag:QV09	5.05		5.065	5.05
SCL_Mag:DCV09	-0.00037209		-0.00040288	
SCL_Mag:QH10	5		5.0095	5
SCL_Mag:DCH10	0.0011334		0.0011023	
SCL_Mag:QV10	5		5.0122	5

- Bug fixes
- Bind to Book value
- Memorize Value
- Restore Original value (cached per PV)
- Support for arbitrary PVs

Optics Editor

Tom Pelaia

- Edit the hardware status of a device
 - Many applications check a device's status to determine whether to use it
- Quick filter search
- Provide a comment explaining the status



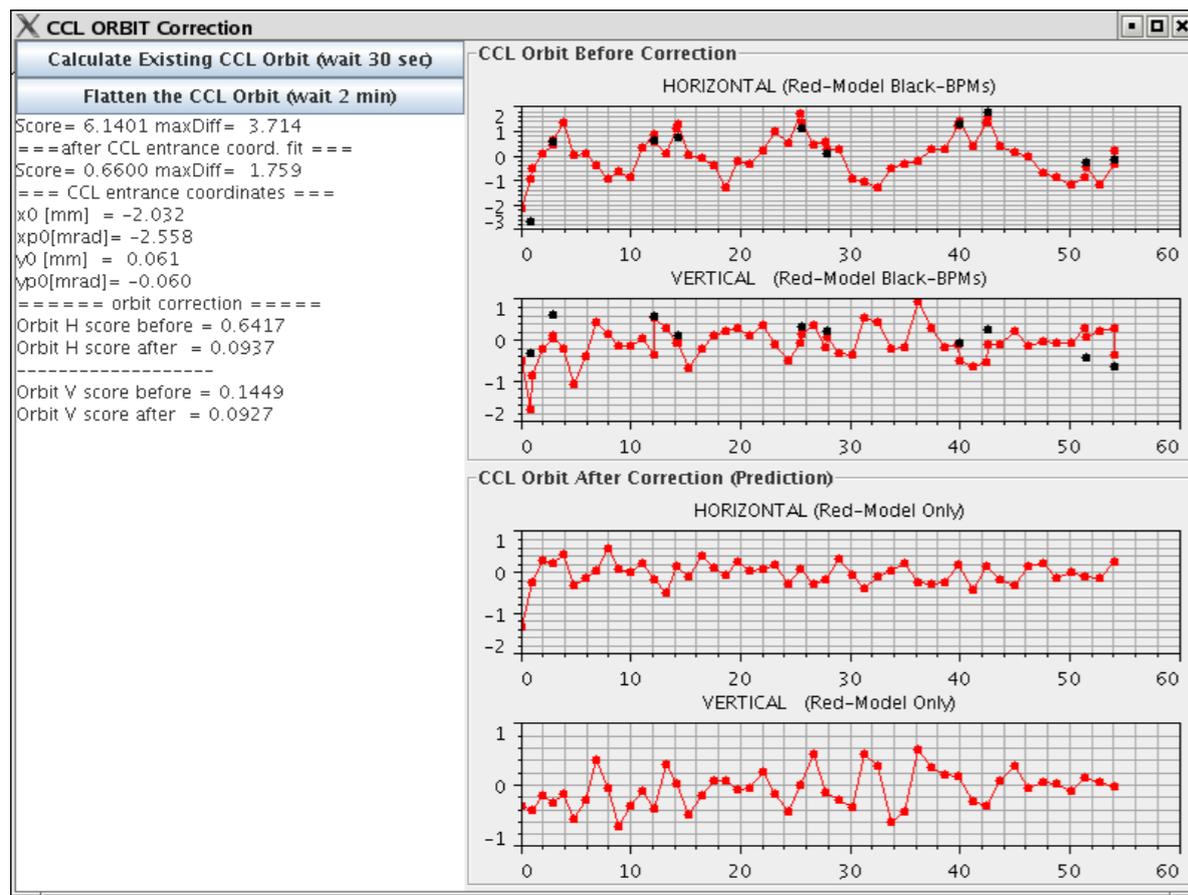
The screenshot shows the 'Optics Editor' application window. The title bar reads 'gov.sns.apps.opticseditor.Main'. The menu bar includes 'File', 'Edit', 'Nodes', 'View', 'Window', and 'Help'. The main window title is 'Optics Editor - /Users/t6p/Projects/xal/main/xal_xmls/main.xal*'. Below the title bar is a toolbar with icons for file operations and a 'Disable' button. The interface features a search area with 'Node Name' (containing 'BPM Ring') and filters for 'Status' (Any, Good, Bad), 'Inclusion' (Any, Included, Excluded), and 'Modification' (Any, Modified, Unmodified). The main area displays a table of nodes:

Node	Sequence	Comment	Status	Excluded	Modified
Ring_Diag:BPM_A01	Ring4		Enabled		
Ring_Diag:BPM_A02	Ring4		Enabled		
Ring_Diag:BPM_A03	Ring4		Enabled		
Ring_Diag:BPM_A04	Ring4		Enabled		
Ring_Diag:BPM_A05	Ring4		Enabled		
Ring_Diag:BPM_A06	Ring4		Enabled		
Ring_Diag:BPM_A07	Ring4		Enabled		
Ring_Diag:BPM_A08	Ring4	Demo	Disabled		Modified
Ring_Diag:BPM_A09	Ring4		Enabled		
Ring_Diag:BPM_A10	Ring5	Just a test	Disabled		Modified
Ring_Diag:BPM_A13	Ring1		Enabled		
Ring_Diag:BPM_B01	Ring2		Enabled		
Ring_Diag:BPM_B02	Ring2		Enabled		
Ring_Diag:BPM_B03	Ring2		Enabled		
Ring_Diag:BPM_B04	Ring2		Enabled		
Ring_Diag:BPM_B05	Ring2		Enabled		
Ring_Diag:BPM_B06	Ring2		Enabled		
Ring_Diag:BPM_B07	Ring2		Enabled		
Ring_Diag:BPM_B08	Ring2	Something to show	Disabled		Modified
Ring_Diag:BPM_B09	Ring2		Enabled		
Ring_Diag:BPM_B10	Ring2		Enabled		
Ring_Diag:BPM_B13	Ring2		Enabled		
Ring_Diag:BPM_C01	Ring2		Enabled		
Ring_Diag:BPM_C02	Ring2		Enabled		
Ring_Diag:BPM_C03	Ring2		Enabled		
Ring_Diag:BPM_C04	Ring2		Enabled		
Ring_Diag:BPM_C05	Ring2		Enabled		
Ring_Diag:BPM_C06	Ring2		Enabled		
Ring_Diag:BPM_C07	Ring2		Enabled		
Ring_Diag:BPM_C08	Ring2		Enabled		
Ring_Diag:BPM_C09	Ring2		Enabled		
Ring_Diag:BPM_C10	Ring3		Enabled		
Ring_Diag:BPM_C13	Ring4		Enabled		
Ring_Diag:BPM_D01	Ring4		Enabled		
Ring_Diag:BPM_D02	Ring4		Enabled		
Ring_Diag:BPM_D03	Ring4		Enabled		
Ring_Diag:BPM_D04	Ring4		Enabled		
Ring_Diag:BPM_D05	Ring4		Enabled		
Ring_Diag:BPM_D06	Ring4		Enabled		
Ring_Diag:BPM_D07	Ring4		Enabled		
Ring_Diag:BPM_D08	Ring4		Enabled		
Ring_Diag:BPM_D09	Ring4		Enabled		
Ring_Diag:BPM_D10	Ring4		Enabled		
Ring_Diag:BPM_D13	Ring4		Enabled		

CCL Orbit Correction

Andrei Shishlo

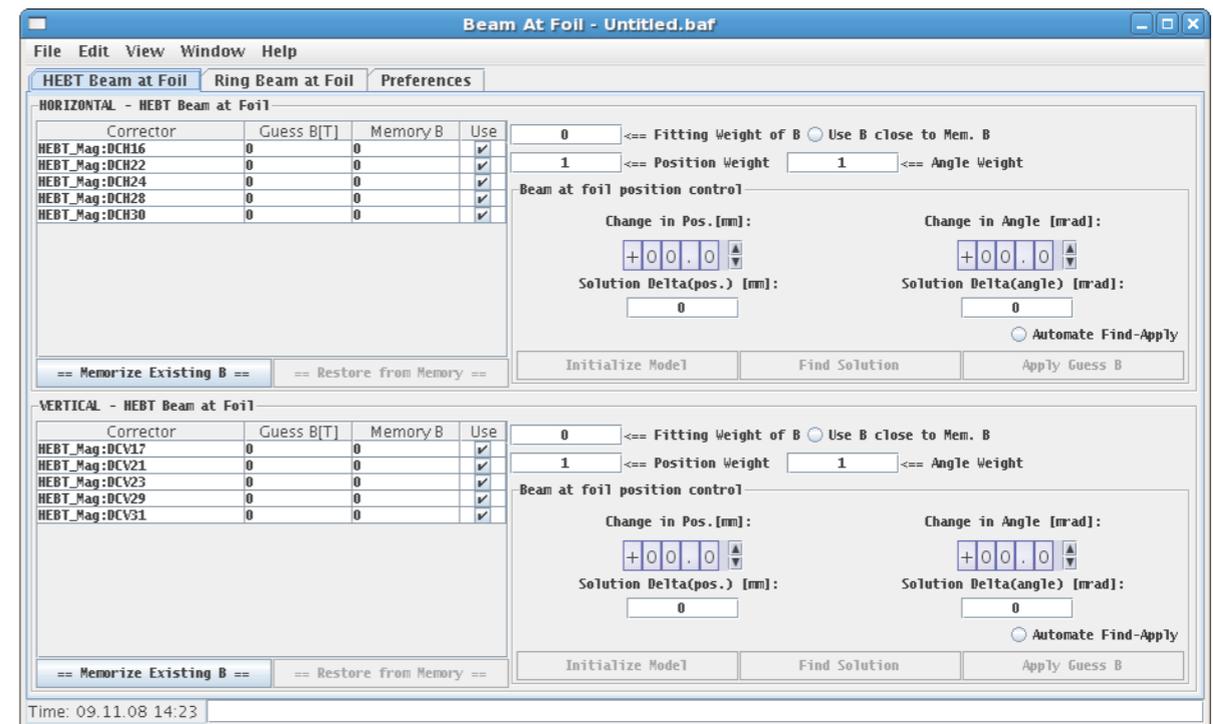
- Measure the orbit at locations throughout the CCL
 - Measure orbit at BPMs
 - Apply BPM offsets
 - Project orbit to points between the BPMs using online model
- Correct the orbit throughout the CCL



Beam at Foil Control

Andrei Shishlo

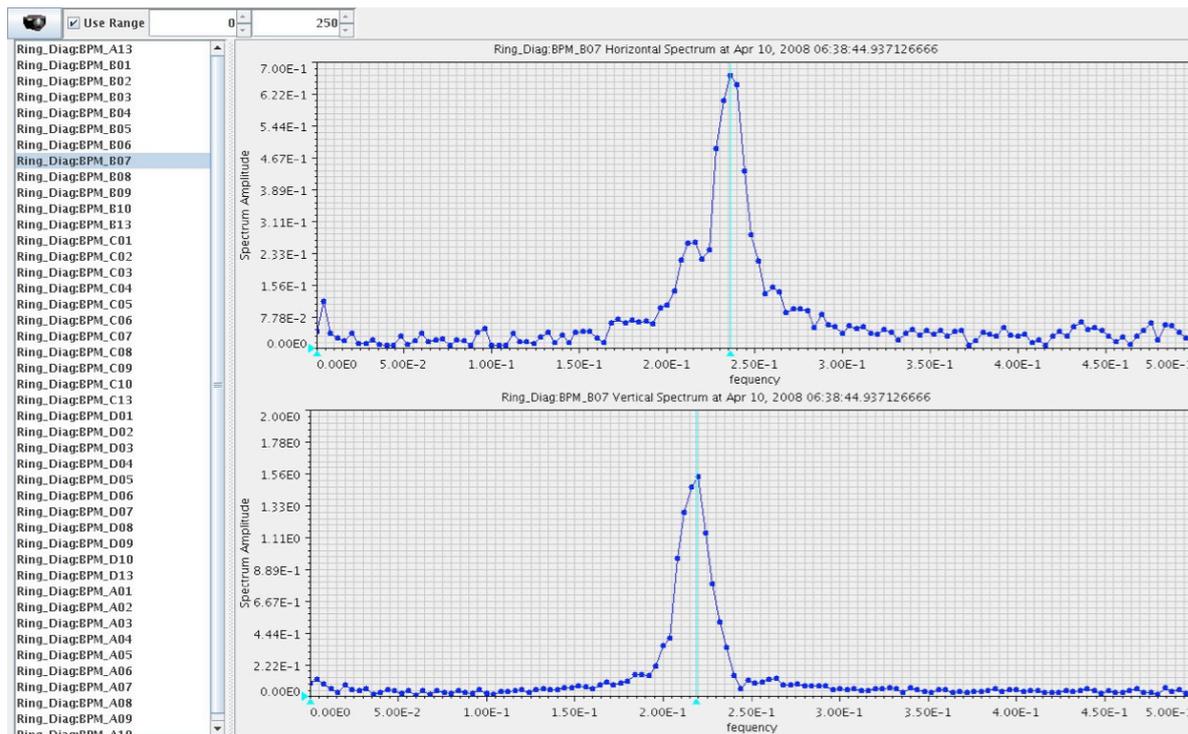
- Measure orbit at the Foil from HEBT and Ring
 - Measure orbit at BPMs about the foil
 - Use online model to project orbit to the foil



Ring Tune Monitor

Tom Pelaia

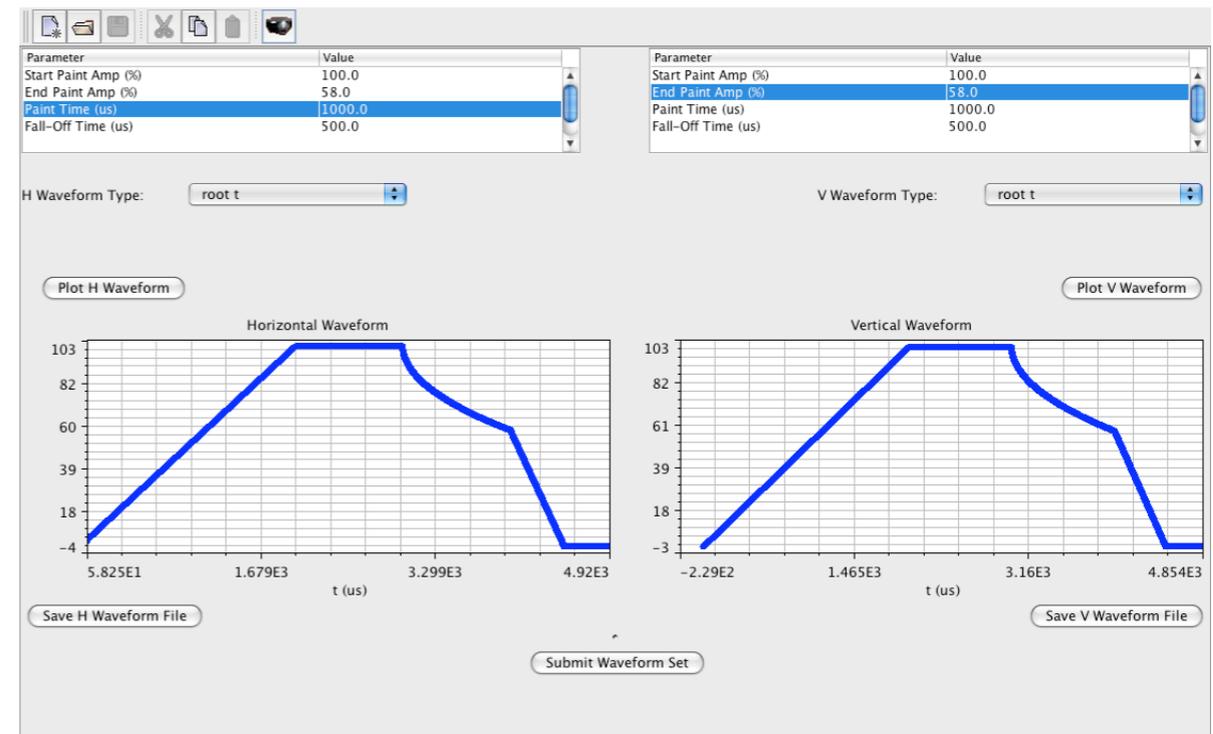
- Calculate and display the live fractional ring tunes
 - Monitor the turn by turn beam position at a selected BPM
 - Perform a discrete Fourier Transform of the BPM data for each transverse plane
 - Display the fractional tunes



Injection Painting

Sarah Cousineau

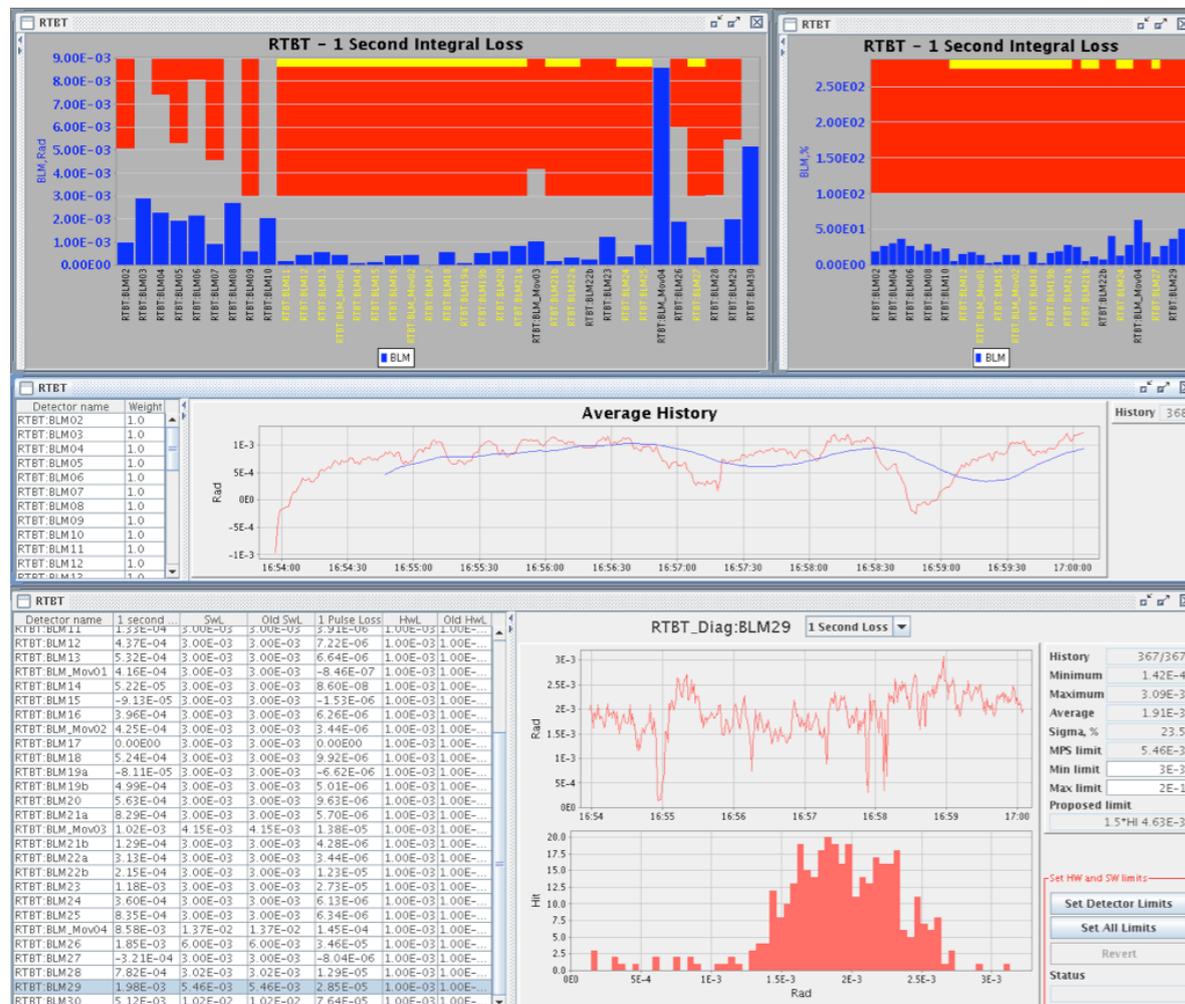
- **Injection kicker painting**
 - **Generate a waveform matching start and end amplitudes and timing information**
 - **Save waveform to a file which can be loaded**
 - **Send the specified injection kicker waveforms to the machine**



Loss Viewer 2 Enhancements

Alexander Zhukov

- Added an MPS Limit Controller
- Histogram of any particular BLM loss distribution with history plot
- Plot of the weighted average beam loss for an accelerator sequence



Collaboration Enhancements

- **New website with documentation and XAL lecture series**
 - <http://www.ornl.gov/~t6p/Main/XAL.html>
 - **RSS News Feed**
 - **Fresh XAL API Documentation**
- **Synchronize Source Forge code with SNS code**

FY09 Roadmap

- **Develop and enhance applications as requested**
- **Cleanup XAL**
- **Improve and enhance the online model**
- **Improve XAL collaboration both inside and outside of SNS**
- **Develop a smarter, more powerful application launcher that eliminates the need to have scripts**
- **Build an agent based system for dynamically distributing services on demand**
- **Investigate Java 6 support**

Cleanup XAL (FY09)

- **Reduce the number of third party jar files and better document the remaining ones on which we depend**
- **Migrate the remaining applications which depend on the proprietary charting packages to use the open source charting options**
- **Remove deprecated applications and code**
- **Fix broken Javadoc documentation**

Online Model Changes (FY09)

- **Improve online synching performance using batch CA operations and monitors**
- **Fix the space charge bug in which the online model fails in the presence of bends**
- **Support multipole magnets**

XAL Collaboration (FY09)

- **Post and maintain API documentation**
- **Provide online resources and tutorials**
- **Support developers from the operations group**
- **Maintain the Source Forge repository and create site specific branches**
- **Provide an XAL Lite branch which isolates the application framework**

References

- **Home:** <http://www.ornl.gov/~t6p/Main/XAL.html>
- **News Feed:** <http://www.ornl.gov/~t6p/Main/XALBlog/XALBlog.html>
- **Source Code:** <http://sourceforge.net/projects/xaldev>
- **XAL 2:** <http://sourceforge.net/projects/xal2>